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Heat Drying Coals at Moderate Temperatures Before Coking

H. W. Jackman
R. J. Helfinstine

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John C. Frye, *Chief*

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ABSTRACT

Preheating coals to near plastic temperatures before charging into commercial coke ovens could create severe operating problems. The less drastic procedure of partially or completely predrying coals at 250° F before charging the coke ovens may be more desirable. Advantages of predrying over conventional practices would be to decrease coking time, increase coke-oven productivity, and possibly improve physical properties of the coke. These advantages may be available through predrying without encountering the problems which would occur with higher preheating temperatures.

The predrying procedure has been applied to a number of coal blends charged into the pilot coke oven at the Illinois State Geological Survey. Coal moisture has been reduced in small increments and the heated, partially dried coals were charged into the oven and coked. Results of these tests were as follows: (1) coking time has been reduced and coke-oven productivity has increased; (2) physical properties of the coke have changed only slightly, and coke yields, based on dry coal weights, have not been significantly affected; (3) coke-oven wall pressures were consistently greater with the predried coals, but were not excessive.

INTRODUCTION

Preheating coals on a commercial scale to temperatures well above those required to drive off moisture, and then charging these preheated coals into hot coke ovens could result in formidable operating problems. To avoid these operating problems a less drastic procedure of charging predried or partially predried coal at a temperature near 250° F may be preferred.

Such a coal drying procedure has been described by Yoshida (1967) who reviewed testing programs at three Japanese coke plants. Coals were partially heat dried, and the moisture reduced from about 8 percent to the range of 3.6 to 5.6 percent before charging into commercial coke ovens. Coking time was reduced 2 to 10 percent, and coke-oven productivity increased 6 to 16 percent. The coke was stronger, and underfiring costs were lower. Problems to be solved before commercializing this procedure include design of a large-scale coal drier and prevention of the passage of coal dust into the gas mains and into the atmosphere.

Similar coal drying tests have been made in pilot or experimental ovens throughout the world. The following examples are representative of these tests. Coals have been heat-dried from 9 to about 5 percent moisture and coked in the experimental 10-ton coke oven of the British Coke Research Association. Hall et al., (1963) reported that coking time was decreased by 10 minutes for each one percent decrease in coal moisture. French investigators (Loison, 1958) used an experimental four-oven battery and reported that coking time was decreased as coal moisture was reduced to 5 percent, but below this moisture level coking time increased.

American investigators (Doherty et al., 1962) used a pilot oven and found that coking time was decreased as moisture was reduced from $9\frac{1}{2}$ to 7 percent. Further reduction in moisture to $4\frac{1}{2}$ percent caused the coking time to increase again to the original value.

Bulk density of a coal charge in a coke oven may increase as moisture is reduced, thereby making it possible to charge more coal per cubic foot of oven space. This means a corresponding increase in coke production per oven. Investigations (Hall et al., 1963) with the British experimental 10-ton coke oven indicated that for each one percent reduction in moisture a 2.4 percent increase in coal throughput should result. This increase was presumed to be the result of both the reduction in moisture and the higher bulk density.

Similar studies in America (Brisse, 1959) showed a 6 percent increase in coal throughput when coal was dried from 9.5 to 5 percent moisture. This is a 1.33 percent increase for each one percent reduction in moisture. The combination of increased bulk density and reduced coal moisture may account for some of the variability in coking time and coal throughput reported.

In view of the world-wide interest in the effects of coal drying before coking it seemed advisable to determine the advantages which may result from predrying coal blends, especially those blends which are similar to the ones being coked in the Chicago and St. Louis areas. The primary interest was to determine to what extent coking time could be reduced as the coal was partially or completely dried, how this might affect coke-oven productivity, and how the physical properties of the resulting cokes might be affected.

Equipment and Procedures

The coal preheater, built in the Survey laboratories and described in Circular 423 (Jackman and Helfinstine, 1968a) consists of a cylindrical drum which, when partially filled, holds 700 pounds of coal. The drum is rotated in a heated oven until coal moisture is decreased to a desired level. The drum is then removed from the oven, upended over the pilot coke oven, and the heated coal discharged into the oven and coked under standard operating conditions. Oven flue temperatures are maintained at 2350° F. Coking is continued until the temperature at the center of the coal charge reaches 1775° F, at which time coking is assumed to be complete. The coke is pushed from the oven and tested by standard ASTM procedures. A record of the coking time and coal bulk density is made, and the coke-oven productivity in pounds of coke per cubic foot of oven space per 24 hours is calculated.

Acknowledgments

We wish to acknowledge the assistance and cooperation of the Illinois coal operators and the coke producers in the Chicago and St. Louis areas. They have supplied the coals used in the tests and have made other valuable contributions.

TESTING PROGRAM

Five coal blends similar to those being used in the Chicago and St. Louis areas were tested to determine the effect of partially or completely drying coals before coking. Four of these blends had been used in a previous study to determine the effects of preheating to higher temperatures and the results were reported in Circular 434 (Jackman and Helfinstine, 1968b). In these previous tests insufficient data were obtained to determine accurately the effects of partial drying.

The original data reported in Circular 434 have been supplemented, therefore, to include coking tests on these blends after partial predrying to different moisture levels. Coking results from each blend have been tabulated, pertinent data plotted, and curves drawn to show the effects of coal drying on coking time, coke properties, and coke-oven productivity.

Chemical analyses of each coal blend tested, and the average analyses of the cokes made from each of these blends are shown in table A of the Appendix. Complete coking test data for all blends are also given in the Appendix.

RESULTS OF TESTS

Blend A

Experimental coke-oven data from Blend A are shown in figure 1, and in table B of the Appendix. Blend A consisted of 60 percent Illinois No. 6, 20 percent Illinois No. 5, and 20 percent Pocahontas coals. It had a high moisture content of 7.5 percent as received and first tested and the coking time required was 16 hours and 45 minutes. Air drying and subsequent heat drying at 210° F reduced this moisture only one percent and caused no reduction in coking time.

Further heat drying this blend at 225° and 230° F reduced the moisture to 3.75 and 3.3 percent. The coking time was reduced to 15 hours and 5 minutes and 14 hours and 30 minutes respectively. Drying at 260° F reduced moisture to 1.1 percent, and coking time to 13 hours and 45 minutes. Figure 1 shows that the coking time was reduced very consistently as coal moisture was lowered.

Figure 1 also shows that coke-oven productivity increased about 7 percent when half of the original moisture was removed, and increased by 25 percent when moisture was reduced to 1.1 percent. Dry-coal bulk density was increased at the lowest moisture content, and coke physical properties were not significantly affected by predrying. The coke-oven wall pressure was increased from 0.6 to a maximum of 1.5 pounds per square inch.

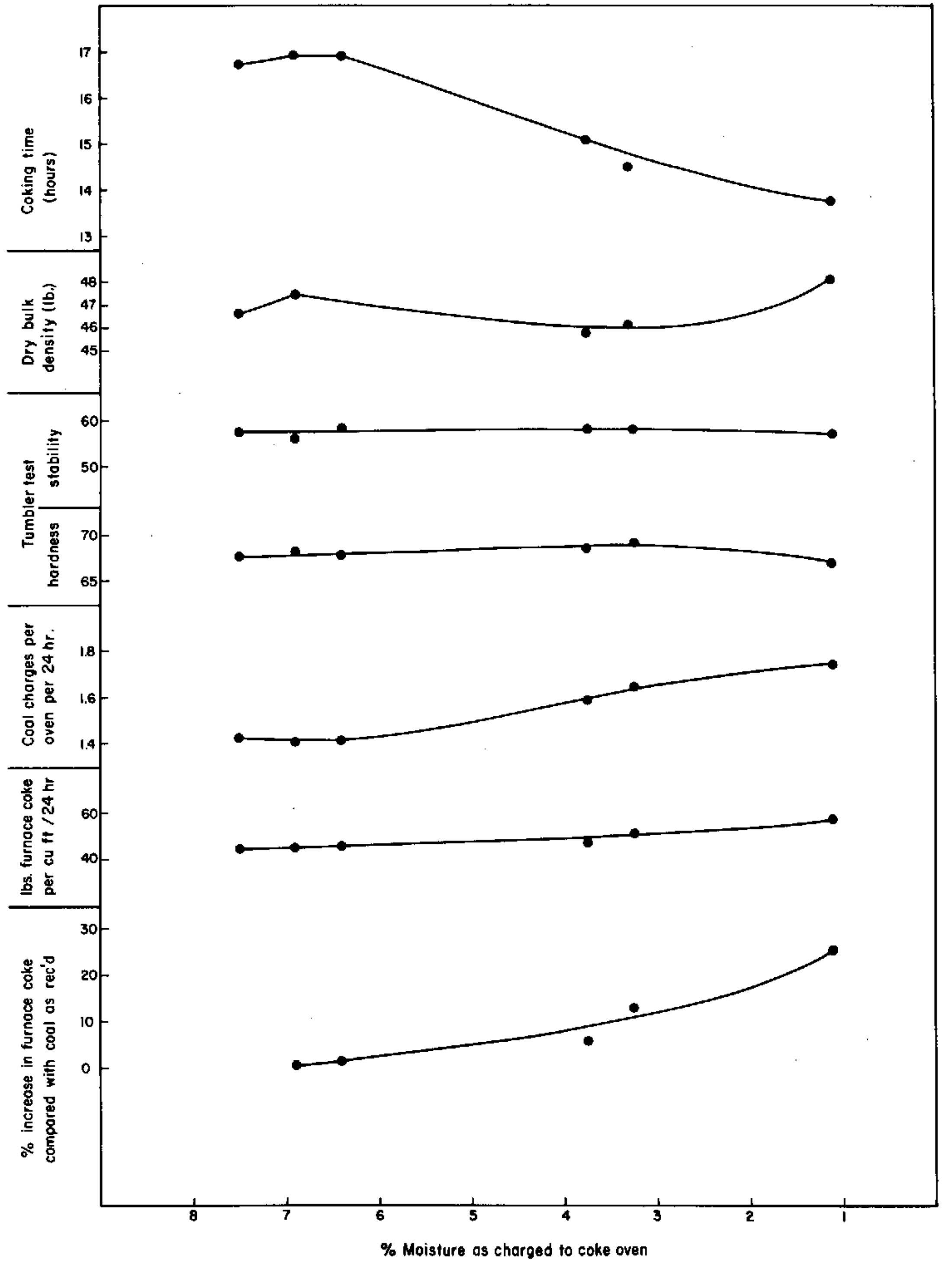

Figure 1 - Results of coking tests on Blend A.

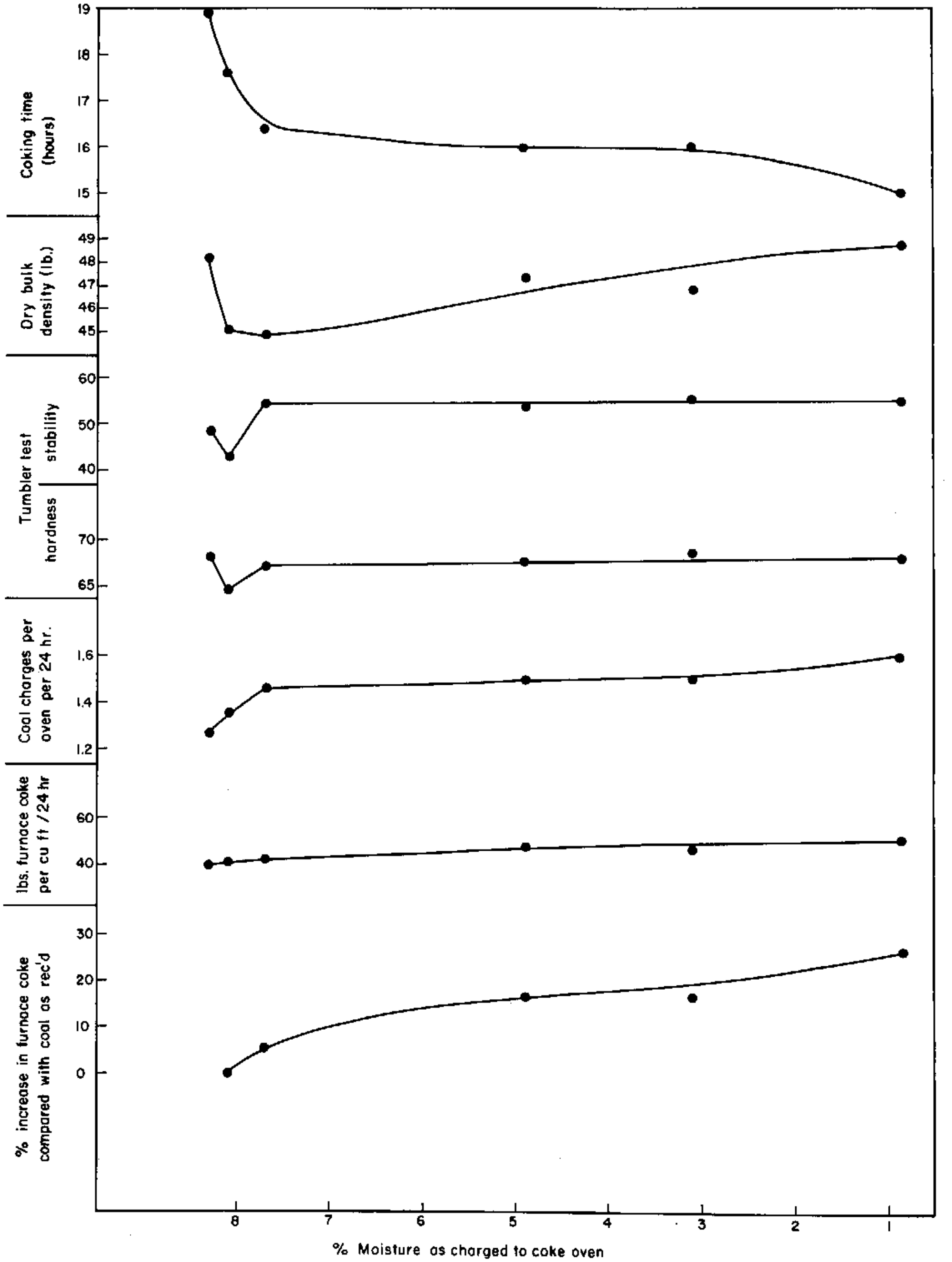

Figure 2 - Results of coking tests on Blend B.

Blend B

Blend B consisted of 85 percent Illinois No. 6 coal and 15 percent of a medium-volatile Pocahontas seam coal from West Virginia. Results of predrying this blend to a minimum of 0.85 percent moisture are shown in figure 2 and in table C of the Appendix. This blend of coals contained 8.3 percent moisture as originally received, the highest of all blends tested.

Air drying Blend B had little effect on coal moisture but did cause an appreciable reduction in the dry-coal bulk density. The reason for this reduction in bulk density is not known and was unexpected. Further drying at 200° F reduced coal moisture to 7.7 percent. Bulk density remained essentially unchanged and the coking time was reduced from the initial 18 hours and 55 minutes to 16 hours and 25 minutes, a reduction of two and one-half hours. There was a net increase in coke-oven productivity of 5.5 percent.

Further predrying at 230° F to a moisture content of 3.1 percent caused a further reduction in coking time to 16 hours, and increased coke-oven productivity by 16.3 percent. This coal was then predried to 0.85 percent moisture by preheating to 255° F in the drying drum, and the coking time was decreased to 15 hours. Coke-oven productivity rose correspondingly by 26.2 percent of the original value. This final reduction in blend moisture caused the dry-coal bulk density to increase again to a value similar to that obtained with the "as received" coal.

Physical properties of the cokes produced from the predried coals were not affected appreciably except as follows. The coke stability index decreased for coke made from the air-dried coal, but increased with further drying from the original 48.9 to the middle fifties where it remained essentially constant. The hardness index followed the same trend and remained in the range from 67 to 68 with the more completely dried coals.

Blend C

Blend C consisted of 40 percent Illinois No. 6, 40 percent Sewell, and 20 percent Pocahontas coals. Results of predrying this blend are shown in figure 3 and in table D of the Appendix. Coal moisture as received and first coked was 6.1 percent. This was reduced by air-drying to 4.8 percent, and further reduced by heat-drying in three steps to a minimum of 0.8 percent.

Air drying this blend of coals caused the dry-coal bulk density to increase from 46.2 to 48.5 pounds per cubic foot with a corresponding increase in coking time from 16 hours and 20 minutes to 17 hours and 40 minutes. Coke-oven productivity dropped 3.7 percent. As the coal was dried further to a minimum of 0.8 percent moisture the dry-coal bulk density remained fairly constant at about 47 pounds per cubic foot, and coke-oven productivity increased by a maximum of 17.2 percent.

Coke physical properties with this blend were not affected greatly by predrying. Tumbler indices were fairly uniform except for the lower hardness index of the coke made from 0.8 percent moisture coal. There was some variation in coke size but no major or consistent trend. Coke yields were nearly constant throughout the series, and pressure on oven walls was increased to 1.35 pounds per square inch at the shortest coking time.

Blend D

Blend D which consisted of 45 percent Eastern Kentucky, 30 percent Illinois No. 6, and 25 percent Pocahontas coals, contained less Illinois coal and less "as received" moisture than any of the previous three blends studied. Results of

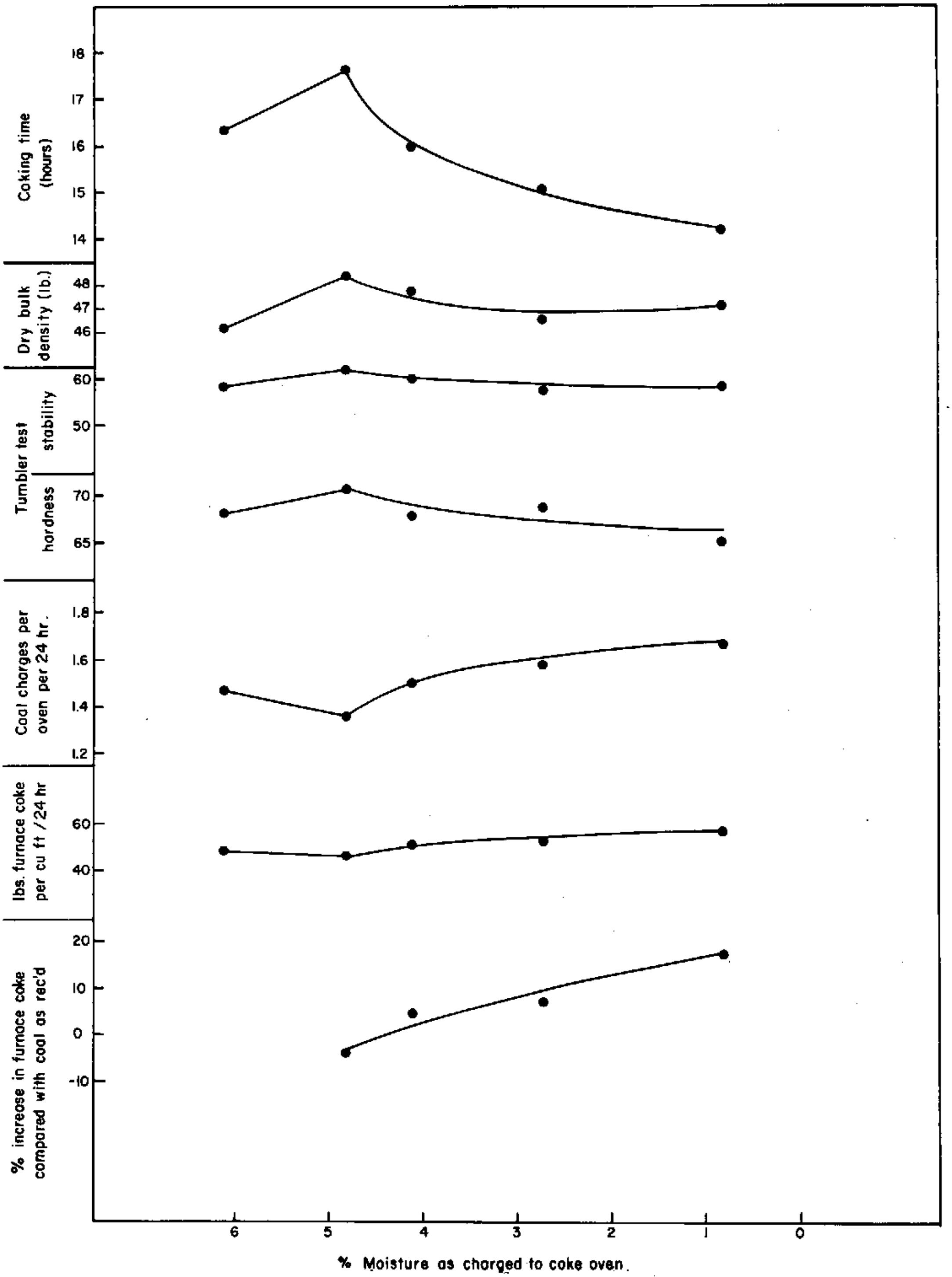

Figure 3 - Results of coking tests on Blend C.

predrying this coal from an "as received" moisture content of 5.0 percent to a predried moisture of 0.9 percent are shown in figure 4 and in table E of the Appendix.

Air drying this coal blend reduced the moisture to 4.5 percent and caused the dry-coal bulk density to increase from 47.2 to 49.2 pounds per cubic foot. However, the air-dried coal coked in 10 minutes less time than did the coal as received, and the coke-oven productivity increased 5.9 percent.

Preheating this blend at 210°, 223° and 320° F reduced the coking time from 16 hours and 40 minutes to 15 hours and 45 minutes, 15 hours and 30 minutes, and 14 hours and 18 minutes respectively; when plotted as in figure 4, these values give essentially a straight line. Coke-oven productivity increased a maximum of 18.5 percent.

Physical properties of the cokes produced from this blend showed very little change and no significant trends with more complete drying. Yields of furnace-size coke and of coke screenings likewise showed very little variation. The pressure exerted on coke-oven walls increased to a maximum of 1.5 pounds per square inch.

Blend E

Blend E consisted of 75 percent Eastern Kentucky and 25 percent low-volatile Pocahontas coals and was the only blend tested that did not contain Illinois coal. The "as received" moisture (3.7 percent) was reduced to 2.9 percent by air drying. This coal was predried to a maximum temperature of 350° F which is higher than normal for this series, in order to reduce moisture essentially to zero and so widen the range of moisture values at which it was tested. Results of this series of tests are shown in figure 5 and in table F of the Appendix.

Air drying increased the bulk density of this coal blend from 45.5 to 48.8 pounds per cubic foot. With further drying, the density became constant at 46.0 pounds per cubic foot. Coking time, which was 15 hours and 50 minutes for the "as received" coal, increased 20 minutes with air drying, but then decreased almost linearly to 13 hours and 30 minutes as the coal was dried further. Coke-oven productivity increased only 6.3 percent as the coal moisture was decreased to 1.1 percent, but increased by 16.1 percent when moisture was lowered to 0.1 percent.

Both stability and hardness indices increased slowly but consistently as coal moisture was reduced to 1.1 percent, but then decreased to near the original values in the final test with coal containing 0.1 percent moisture. Coke sizing remained fairly uniform throughout this series of tests, and oven-wall pressure increased to a maximum of 1.65 pounds per square inch with a coal moisture of 2.2 percent.

CONCLUSIONS

The results of these predrying tests on five coal blends, four of which included varying percentages of Illinois coals, show the following trends:

(1) Coking time was reduced 25 to 35 minutes for each percent of moisture removed by predrying. The coals were charged into the coke oven at the temperatures attained in the drier, normally not above 250° F.

(2) When carbonizing coal blends, containing 30 percent or more of Illinois coals, the productivity of a coke oven (pounds of coke produced per cubic foot

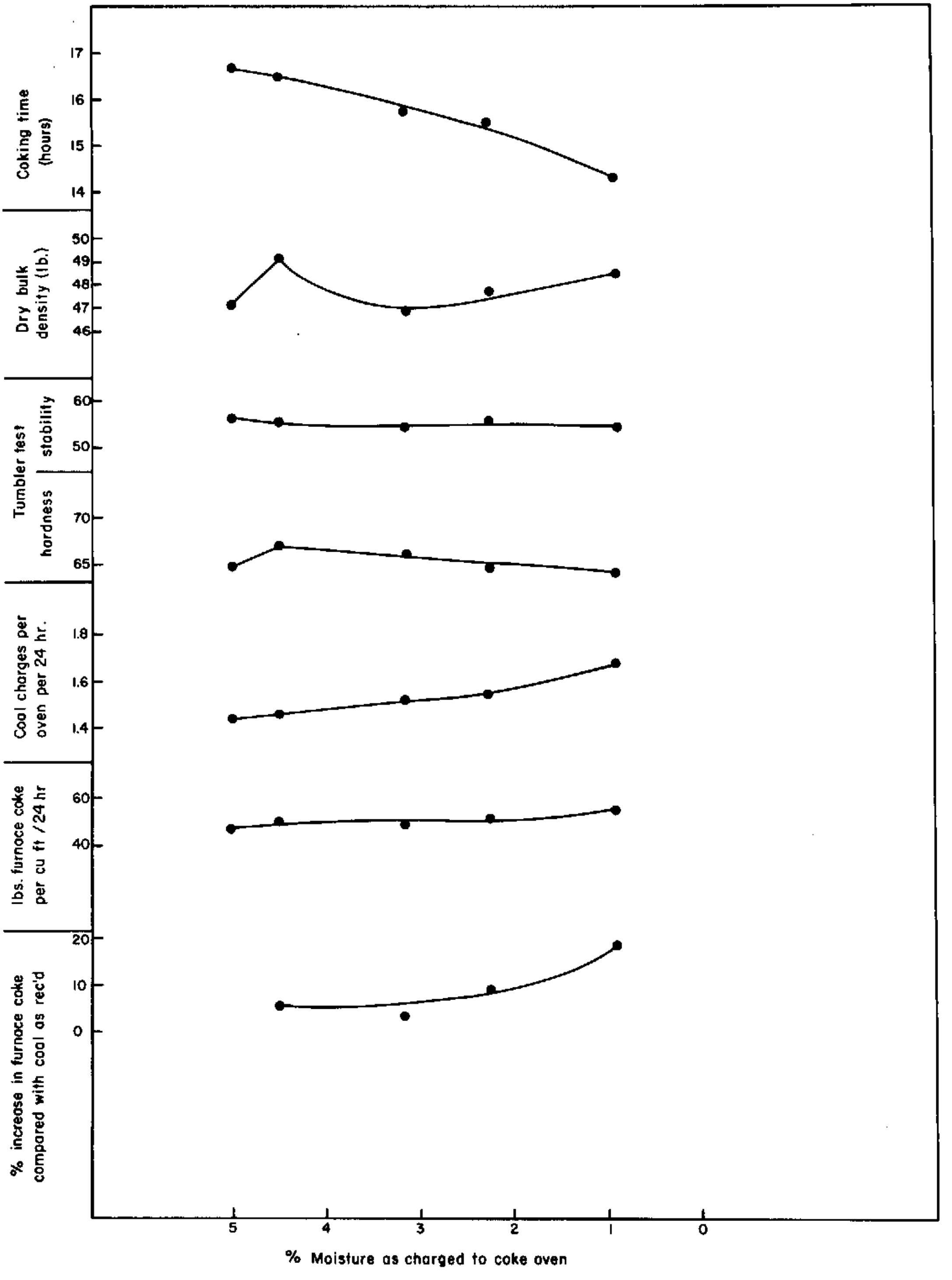

Figure 4 - Results of coking tests on Blend D.

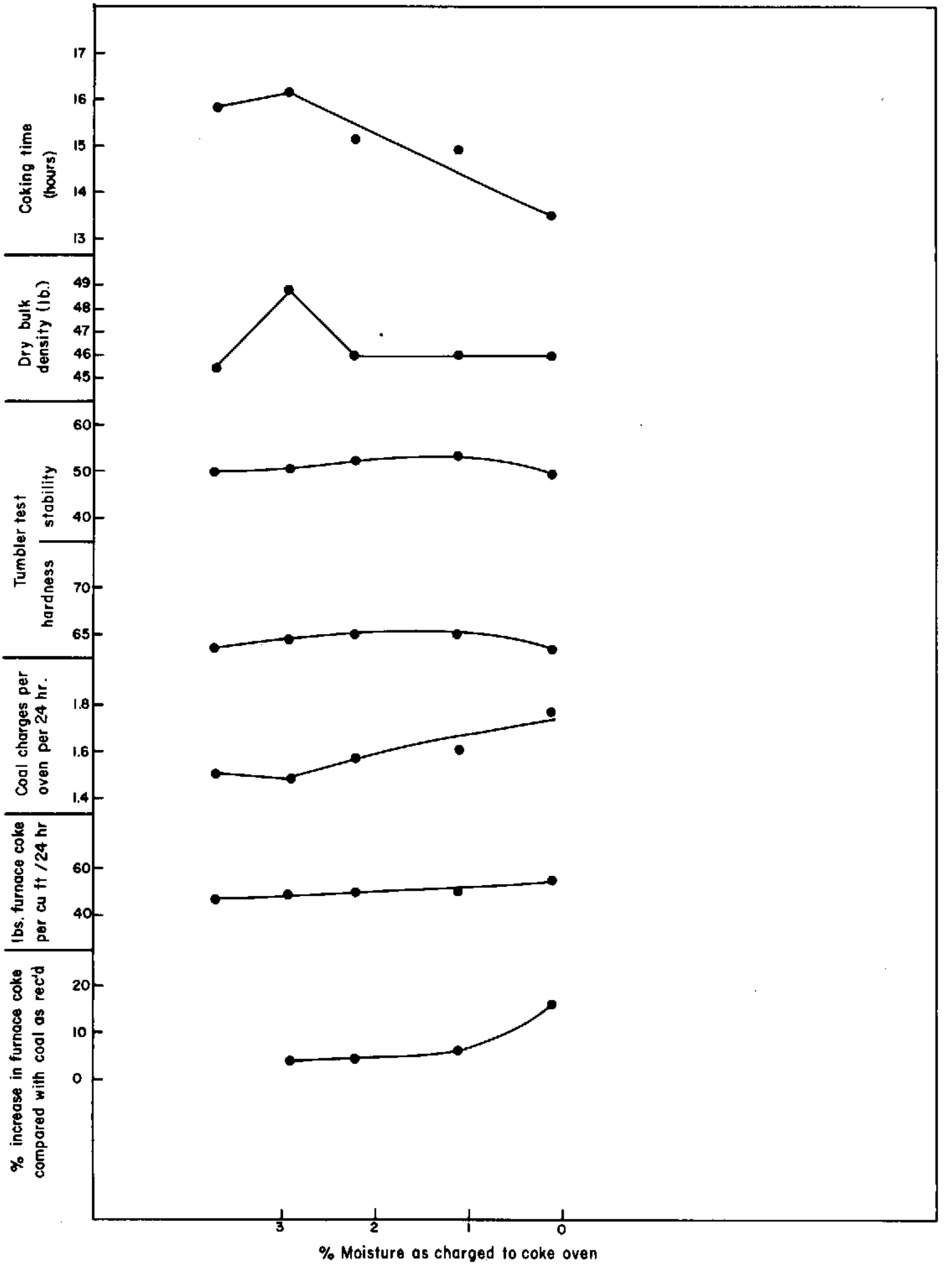

Figure 5 - Results of coking tests on Blend E.

of oven space per 24 hours) was shown to increase 3.5 to 4.5 percent for each percent of moisture removed by predrying down to approximately 1.0 percent moisture. A low-moisture blend containing all eastern coals showed a productivity increase of only 2.4 percent for each percent of moisture removed by predrying down to the same moisture level.

(3) Physical properties of the cokes produced were changed only slightly by drying the coal before coking.

(4) Coke yields were not affected significantly by predrying.

(5) The pressure exerted on coke oven walls during coking was increased consistently by predrying from an initial 0.5 pounds per square inch with "as received" coals to a range of 1.15 to 1.65 pounds per square inch. The greatest increase in wall pressure was attained when coking a low-moisture, all-eastern coal blend.

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APPENDIX

Table A of this section shows chemical analyses of the coal blends tested and of the cokes produced from them in the pilot coke oven. Tables B through F present the complete pilot plant coking results for each of the coal blends studied and described. Data include predrying temperatures, coking time, dry-coal bulk densities, coke physical properties, coke yields, coal pulverization, moisture in "as received" and predried coal blends, and the effect of predrying on the productivity of the coke oven.

TABLE A - ANALYSES OF COAL BLENDS AND COKES PRODUCED[1]

Coal blend	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Sulfur (%)	Free swelling index	Maximum Gieseler fluidity (dial div per min)
Blend A							
60% Illinois No. 6 20% Illinois No. 5 20% Pocahontas							
Coal	7.5	33.0	59.8	7.2	1.07	5	11
Coke	(aver. 6 tests)	1.2	88.7	10.1	0.82		
Blend B							
85% Illinois No. 6 15% Med.-Vol. Pocahontas							
Coal	8.3	36.6	56.7	6.7	1.07	5½	57
Coke	(aver. 6 tests)	1.2	89.7	9.1	0.86		
Blend C							
40% Illinois No. 6 40% Sewell 20% Pocahontas							
Coal	6.1	30.3	63.9	5.8	0.83	6½	43
Coke	(aver. 5 tests)	1.1	90.5	8.4	0.65		
Blend D							
45% Eastern Kentucky 30% Illinois No. 6 25% Pocahontas							
Coal	5.0	33.0	60.9	6.1	1.11	6	268
Coke	(aver. 5 tests)	1.1	90.1	8.8	0.85		
Blend E							
75% Eastern Kentucky 25% Pocahontas							
Coal	3.7	32.5	61.0	6.5	1.29	7	890
Coke	(aver. 5 tests)	0.9	89.9	9.2	1.03		

[1] Chemical analyses by the Analytical Chemistry Section of the Illinois State Geological Survey. Volatile matter, fixed carbon, ash and sulfur on dry coal basis.

TABLE B – RESULTS OF COKING TESTS ON BLEND A

Blend A 60% Illinois No. 6 20% Illinois No. 5 20% Pocahontas	Condition of coal					
	As rec'd	Air dried	Heat dried at 210° F	Heat dried at 225° F	Heat dried at 230° F	Heat dried at 260° F
	Run number					
	1058 E	1159 E	1160 E	1298 E	1299 E	1056 E
Coking time (hr:min)	16:45	16:55	16:55	15:05	14:30	13:45
Bulk density (dry coal; lb per cu ft)	46.7	47.5	—	45.8	46.2	48.1
Coke physical properties						
Tumbler test						
Stability	57.7	56.2	58.4	58.2	58.2	57.0
Hardness	67.8	68.5	68.0	68.6	69.3	67.2
Shatter test						
+2"	75.4	69.0	73.0	70.8	65.6	75.8
+1½"	90.2	90.0	91.0	89.8	87.8	91.0
+1"	95.2	96.0	96.0	95.4	95.0	96.2
Sizing (%)						
+4"	5.2	6.6	6.2	4.5	4.0	5.0
4" x 3"	26.2	29.5	28.1	29.8	29.7	28.3
3" x 2"	43.1	40.9	42.4	41.2	43.9	42.3
2" x 1"	20.1	17.1	17.8	19.7	17.5	19.6
1" x ½"	1.4	1.7	1.9	1.7	1.8	2.0
-½"	3.7	4.2	3.6	3.1	3.1	2.8
Average size (in.)	2.55	2.63	2.61	2.59	2.60	2.59
Apparent gravity	0.805	0.815	0.815	0.80	0.815	0.80
Coke yields (% of dry coal)						
Total coke (dry)	72.5	71.6	71.8	70.5	70.5	71.2
Furnace (+1") (dry)	68.7	67.5	68.0	67.1	67.0	67.8
Nut (1" x ½") (dry)	1.1	1.2	1.3	1.2	1.3	1.4
Breeze (-½") (dry)	2.7	2.9	2.5	2.2	2.2	2.0
Oven wall pressure (lb per sq in.)	0.65	0.60	0.65	1.15	0.8	1.3
Pulverization (-1/8")	—	86.2	84.0	81.5	79.8	82.6
Coke temperature (°F)	1775	1775	1775	1775	1775	1775
% moisture in coal as charged	7.5	6.9	6.4	3.75	3.3	1.1
Coke oven capacity						
Coal charges/oven/24 hr	1.43	1.42	1.42	1.59	1.65	1.74
Lb furnace coke/cu ft/24 hr	45.3	45.5	46.0	47.8	51.2	56.7
% increase in furnace coke (compared with coal "as received")	—	0.4	1.5	5.5	13.0	25.2

TABLE C - RESULTS OF COKING TESTS ON BLEND B

Blend B 85% Illinois No. 6 15% Med.-Vol. Pocahontas	Condition of coal					
	As rec'd	Air dried	Heat dried at 200° F	Heat dried at 228° F	Heat dried at 230° F	Heat dried at 255° F
	Run number					
	1229 E	1223 E	1297 E	1268 E	1234 E	1296 E
Coking time (hr:min)	18:55	17:40	16:25	16:00	16:00	15:00
Bulk density (dry coal; lb per cu ft)	48.3	45.1	44.9	47.4	46.8	48.8
Coke physical properties						
Tumbler test						
Stability	48.9	43.0	54.6	53.9	55.5	55.0
Hardness	68.2	64.1	67.3	67.8	68.7	68.0
Shatter test (%)						
+2"	59.0	65.0	63.8	70.2	67.6	55.8
+1½"	82.8	87.2	87.0	88.8	87.0	84.0
+1"	93.6	93.2	94.8	95.6	95.6	93.6
Sizing (%)						
+4"	2.7	6.1	2.3	2.4	5.1	1.4
4" x 3"	25.1	23.9	25.6	25.3	27.0	20.4
3" x 2"	43.4	44.2	27.9	47.6	41.5	50.2
2" x 1"	22.3	19.6	18.5	19.5	21.0	22.8
1" x ½"	2.9	3.0	2.1	2.0	2.1	2.2
-½"	3.6	3.2	3.6	3.2	3.3	3.0
Average size (in.)	2.45	2.54	2.60	2.50	2.55	2.40
Apparent gravity	0.785	0.78	0.76	0.775	0.81	0.785
Coke yields (% of dry coal)						
Total coke (dry)	70.8	69.8	69.2	70.0	70.0	69.0
Furnace (+1") (dry)	66.1	65.4	65.2	66.4	66.2	65.5
Nut (1" x ½") (dry)	2.1	2.1	1.5	1.4	1.5	1.5
Breeze (-½") (dry)	2.6	2.3	2.5	2.2	2.3	2.0
Oven wall pressure (lb per sq in.)	0.5	0.3	0.5	1.0	0.6	1.4
Pulverization (-1/8")	80.9	—	80.5	79.5	79.3	80.2
Coke temperature (°F)	1775	1775	1775	1775	1775	1775
% moisture in coal as charged	8.3	8.1	7.7	4.9	3.1	0.85
Coke oven capacity						
Coal charges/oven/24 hr	1.27	1.36	1.46	1.50	1.50	1.60
Lb furnace coke/cu ft/24 hr	40.5	40.1	42.75	47.2	46.5	51.1
% increase in furnace coke (compared with coal "as received")	—	-.01	5.5	16.5	16.3	26.2

TABLE D – RESULTS OF COKING TESTS ON BLEND C

Blend C 40% Illinois No. 6 40% Sewell 20% Pocahontas	Condition of coal				
	As rec'd	Air dried	Heat dried at 212° F	Heat dried at 218° F	Heat dried at 290° F
	Run number				
	1106 E	1135 E	1108 E	1312 E	1109 E
Coking time (hr:min)	16:20	17:40	16:00	15:05	14:15
Bulk density (dry coal; lb per cu ft)	46.2	48.5	47.8	46.6	47.2
Coke physical properties					
Tumbler test					
Stability	58.7	62.3	60.3	57.5	58.7
Hardness	66.4	70.9	68.0	68.9	65.3
Shatter test					
+2"	81.4	73.0	72.0	73.0	69.0
+1½"	93.0	93.0	94.0	90.6	92.0
+1"	97.0	97.0	97.0	96.0	96.8
Sizing (%)					
+4"	6.0	8.7	5.7	10.4	7.4
4" x 3"	28.4	29.0	24.7	32.6	28.3
3" x 2"	44.5	40.9	45.7	35.8	41.8
2" x 1"	17.0	16.9	20.0	16.6	18.3
1" x ½"	1.2	1.4	1.4	1.6	1.3
–½"	2.9	3.1	2.5	3.0	2.9
Average size (in.)	2.65	2.70	2.58	2.77	2.66
Apparent gravity	0.835	0.87	0.86	0.90	0.83
Coke yields (% of dry coal)					
Total coke (dry)	75.0	74.6	74.3	73.8	75.4
Furnace (+1") (dry)	71.9	71.2	71.4	70.4	72.2
Nut (1" x ½") (dry)	1.0	1.1	1.0	1.2	1.1
Breeze (–½") (dry)	2.1	2.3	1.9	2.2	2.1
Oven wall pressure (lb per sq in.)	0.5	0.7	1.5	0.55	1.35
Pulverization (–1/8")	83.9	81.2	81.7	84.1	83.3
Coke temperature (°F)	1775	1775	1775	1775	1775
% moisture in coal as charged	6.1	4.8	4.1	2.7	0.8
Coke oven capacity					
Coal charges/oven/24 hr	1.47	1.36	1.50	1.59	1.68
Lb furnace coke/cu ft/24 hr	48.8	47.0	51.2	52.2	57.2
% increase in furnace coke (compared with coal "as received")	—	–3.7	4.9	7.0	17.2

TABLE E - RESULTS OF COKING TESTS ON BLEND D

Blend D 45% Eastern Kentucky 30% Illinois No. 6 25% Pocahontas	Condition of coal				
	As rec'd	Air dried	Heat dried at 210° F	Heat dried at 223° F	Heat dried at 320° F
	Run number				
	1068 E	1180 E	1179 E	1067 E	1066 E
Coking time (hr:min)	16:40	16:30	15:45	15:30	14:18
Bulk density (dry coal; lb per cu ft)	47.2	49.2	46.9	47.8	48.5
Coke physical properties					
Tumber test					
Stability	56.5	55.9	54.6	55.7	54.5
Hardness	64.8	67.1	66.2	64.5	64.2
Shatter test					
+2"	81.2	73.2	77.2	78.4	78.0
+1½"	92.6	90.8	93.0	91.0	92.2
+1"	96.4	96.8	96.0	96.4	96.8
Sizing (%)					
+4"	12.6	9.1	11.7	14.4	17.2
4" x 3"	31.0	32.7	34.8	25.4	24.5
3" x 2"	36.2	38.2	33.9	37.7	35.3
2" x 1"	15.8	15.2	14.2	17.8	18.6
1" x ½"	1.6	1.7	2.2	1.6	1.8
-½"	2.8	3.1	3.2	3.1	2.6
Average size (in.)	2.81	2.76	2.82	2.77	2.81
Apparent gravity	0.83	0.85	0.85	0.84	0.84
Coke yields (% of dry coal)					
Total coke (dry)	72.5	73.3	72.1	72.8	71.6
Furnace (+1") (dry)	69.2	69.8	68.3	69.3	68.4
Nut (1" x ½") (dry)	1.2	1.3	1.6	1.2	1.3
Breeze (-½") (dry)	2.1	2.2	2.2	2.3	1.9
Oven wall pressure (lb per sq in.)	0.45	1.1	1.5	0.7	1.3
Pulverization (-1/8")	79.6	85.3	83.6	79.6	79.6
Coke temperature (°F)	1775	1775	1775	1775	1775
% moisture in coal as charged	5.0	4.5	3.15	2.25	0.9
Coke oven capacity					
Coal charges/oven/24 hr	1.44	1.46	1.52	1.55	1.68
Lb furnace coke/cu ft/24 hr	47.1	49.9	48.6	51.5	55.8
% increase in furnace coke (compared with coal "as received")	—	5.9	3.2	9.3	18.5

TABLE F - RESULTS OF COKING TESTS ON BLEND E

Blend E 75% Eastern Kentucky 25% Pocahontas	Condition of coal				
	As rec'd	Air dried	Heat dried at 215° F	Heat dried at 250° F	Heat dried at 350° F
	Run number				
	1193 E	1187 E	1192 E	1191 E	1189 E
Coking time (hr:min)	15:50	16:10	15:10	14:55	13:30
Bulk density (dry coal; lb per cu ft)	45.5	48.8	46.0	46.0	46.0
Coke physical properties					
Tumbler test					
Stability	50.0	50.5	52.8	53.7	49.6
Hardness	62.5	64.3	65.7	65.5	62.1
Shatter test					
+2"	76.4	75.0	68.0	74.8	76.8
+1½"	91.0	90.0	88.0	92.0	91.2
+1"	96.2	95.0	95.0	96.0	96.4
Sizing (%)					
+4"	12.0	12.3	9.8	12.0	9.9
4" x 3"	38.5	31.6	33.7	35.1	33.3
3" x 2"	33.1	37.5	36.1	32.9	35.7
2" x 1"	11.7	13.7	15.5	14.9	15.8
1" x ½"	1.7	2.0	2.2	2.1	2.4
-½"	3.0	2.9	2.7	3.0	2.9
Average size (in.)	2.91	2.82	2.78	2.84	2.77
Apparent gravity	0.805	0.855	0.86	0.845	0.835
Coke yields (% dry coal)					
Total coke (dry)	73.8	72.1	72.2	72.3	71.3
Furnace (+1") (dry)	69.4	68.7	68.6	68.6	67.5
Nut (1" x ½") (dry)	1.2	1.4	1.7	1.5	1.7
Breeze (-½") (dry)	2.2	2.1	1.9	2.2	2.1
Oven wall pressure (lb per sq in.)	0.35	0.95	1.65	1.55	1.05
Pulverization (-1/8")	82.7	83.2	80.1	84.9	83.1
Coke temperature (°F)	1775	1775	1775	1775	1775
% moisture in coal as charged	3.7	2.9	2.2	1.1	0.1
Coke oven capacity					
Coal charges/oven/24 hr	1.51	1.48	1.58	1.61	1.78
Lb furnace coke/cu ft/24 hr	47.6	49.5	49.8	50.8	55.3
% increase in furnace coke (compared with coal "as received")	—	4.0	4.6	6.3	16.1

ILLINOIS STATE GEOLOGICAL SURVEY Urbana, Illinois 61801

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G. R. Eadie, M.S., E.M., Asst. Administrative Engineer
Velda A. Millard, Fiscal Assistant to the Chief
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Richard W. Davis, Ph.D., Southern Illinois University
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Harry V. Leland, Ph.D., University of Illinois
I. Edgar Odom, Ph.D., Northern Illinois University
T. K. Searight, Ph.D., Illinois State University
George W. White, Ph.D., University of Illinois

Topographic mapping in cooperation with the United State Geological Survey.